

SECTION 02936

SEEDING

LANL MASTER CONSTRUCTION SPECIFICATION

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the LEM Civil POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Delete information within "stars" during editing.

Specification developed for ML-3 projects. For ML-1 / ML-2, additional requirements and QA reviews are required.

This specification is to be used for the establishment or reestablishment of vegetation. See LEM Civil Chapter, Section G2050, Landscaping (future) for additional guidance on choosing plant species for high maintenance and other landscaped areas.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preparation of seedbed.
- B. Seeding.
- C. Mulching and erosion control blankets.
- D. Watering and maintenance.

1.2 RELATED SECTIONS

- A. Section 02270, Slope Protection and Erosion/Sediment Control

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01330, Submittal Procedures:
 - 1. Catalog data, including sources of supply for amendments, mulch, tackifier, fertilizer and erosion control blankets.
 - 2. Certification substantiating that material complies with specified requirements.
Submit certified seed bag tags and copies of seed invoices identified by project name.

3. Installation instructions, including proposed seeding schedule. Coordinate with specified maintenance periods to provide maintenance from date of final acceptance. Once schedule is accepted, revise dates only with LANL approval after documentation of delays.

1.4 QUALITY ASSURANCE

A. Contractor Qualifications:

1. Perform work by a single firm experienced with the type and scale of work required and having equipment and personnel adequate to perform the work satisfactorily.

B. Material Quality Control:

1. Provide seed mixture in containers showing species percentages in seed mix; test information including, purity, germination and noxious/restricted weeds; net weight; date of packaging; and location of packaging.
2. Furnish seed labeled in accordance with the requirements of federal and New Mexico statutes and regulations governing seed labeling. Such resulting requirements include but are not necessarily limited to: Federal Seed Act and Amendments, rules and regulations established by the United States Department of Agriculture; the New Mexico Seed Law; and all resulting regulations or restrictions established by New Mexico State University or other authorized entity.
3. In addition, ensure seed mix and its application complies with the requirements of all other federal and New Mexico statutes and regulations governing seeds, plants, and weeds. These requirements include but are not necessarily limited to: the Noxious Weed Control Act and all rules, regulations, or control measures by a noxious weed control district embracing Los Alamos County, New Mexico; and the Harmful Plant Act.

1.5 DELIVERY, STORAGE AND HANDLING

- ##### A.
- Deliver packaged materials in sealed containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at site. Opened or wet seed shall be rejected and returned to the responsible party.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

- ##### A.
- Comply with 01630, Product Options and Substitutions.

2.2 SEED

- ##### A.
- Obtain native grass seed from sources whose origin would ensure site adaptability at LANL. Plant sources from New Mexico or surrounding states are preferred.

- B. Obtain shrub and wildflower seed from sources whose origin would ensure site adaptability at LANL. Plant sources from New Mexico or surrounding states are preferred.
- C. Cover crops (e.g., annual barley, oats, winter rye, etc.) may be used only as a temporary stabilization measure and shall not be used in conjunction with a perennial seed mix.
- D. Furnish certification, showing origin of seed and pure live seed (PLS) content as determined by a certified authority. Provide bags of seed that are tagged and sealed in accordance with the State Department of Agriculture or other local certification authority within the state of origin. The tag or label shall indicate analysis of seed and date of analysis, which shall not be more than 9 months prior to delivery date. Seed may be premixed by the seed dealer and appropriate data indicated on the bag label for each variety.
- E. Seed mixture shall be:

Develop seed mixture from the following guidelines. Choose a minimum of 5 grass species from the list. Should wildflowers be included in the mix, use a ratio of 80 – 90 percent grasses and 10-20 percent wildflowers. Choose 3 –5 species from the forb and wildflowers list. These species are applicable for both undeveloped and urban-interface areas.

NATIVE PERENNIAL MIX

Common Name	Scientific Name	% of Mix
Grasses		
Blue grama*	<i>Bouteloua gracilis</i>	5 – 10%
Galleta grass*	<i>Hilaria jamesii</i>	5- 10%
Mutton grass	<i>Poa fendleriana</i>	10-15%
Sideoats grama*	<i>Bouteloua curtipendula</i>	10-15%
Arizona fescue†	<i>Festuca arizonica</i>	10 – 15%
Prairie junegrass†	<i>Koeleria macrantha</i>	5 – 10%
Bottlebrush squirreltail*	<i>Elymus elymoides</i>	15 – 20%
Little bluestem†	<i>Schizachyrium scoparium</i>	10 – 15%
Indian ricegrass*	<i>Oryzopsis hymenoides</i>	10 – 15%
Mountain brome†	<i>Bormus marginatus</i>	10 – 15%
Sand dropseed*	<i>Sporobolus cryptandrus</i>	1 - 8%
Thickspike wheatgrass	<i>Agropyron dasystachyum</i>	20 – 25%
Needle and Thread grass*	<i>Stipa comata</i>	5 – 10%
New Mexico needlegrass*	<i>Stipa neomexicana</i>	10 - 15%
Sheep fescue	<i>Festuca ovina</i>	10 – 15%
Forbs/ Wildflowers		1%
Firewheel	<i>Gaillardia pulchella</i>	2%
Evening primrose	<i>Oenothera caespitosa</i>	1%
Gooseberry leaf Globemallow	<i>Sphaeralcea grossulariaefolia</i>	1.5%

Common Name	Scientific Name	% of Mix
Scarlet gilia	<i>Ipomopsis aggregata</i>	1%
Plains aster	<i>Aster biglovii</i>	1%
Western yarrow	<i>Achillea millifolium</i>	½%
Fringed sage	<i>Artemisia frigida</i>	1%
Blue flax	<i>Linum perenne lewisii</i>	4%
Scarlet bulgier	<i>Penstemon barbatus</i>	2%
Palmer penstemon	<i>Penstemon palmerii</i>	2%
Prairie coneflower	<i>Ratibida columnifera</i>	1%
Showy golden-eye	<i>Helionurus multiflora</i>	1%
Purple geranium	<i>Geranium caespitosum</i>	5%

*Species particularly suited for especially dry sites

†Species particularly suited for higher elevations (above 7000 ft.)

2.3 STRAW MULCH

- A. Straw shall be stalks from oats, wheat, rye, barley, or rice that are free from noxious weeds, mold, or other objectionable material. At least 65 percent of the herbage by weight of each bale of straw shall be 10 inches in length or longer. Rotted, brittle or molded straw is not acceptable. Straw from introduced grasses is acceptable if cut prior to seed formation. If possible, provide marsh grass composed of mid to tall native grasses (usually tough and wiry grass and grass-like plants found in the lowland areas within the Rocky Mountain Region).

2.4 HYDRAULIC MULCH/TACKIFIER

- A. Provide mulch material consisting of 100 percent virgin wood fibers manufactured expressly from whole wood chips, such as Eco-Fibre, Conwed, etc. Process chips in such a manner as to contain no growth or germination inhibiting factors. Do not produce fiber from recycled material such as sawdust, paper, cardboard, or residue from pulp and paper plants. Provide materials free from contaminants such as lead paint, varnish or other metal contaminants. Hydraulic mulch shall contain non-toxic dye to assist in visually determining even distribution. Mulch material shall meet the following specifications:

<u>Parameter</u>	<u>Value</u>
pH at 3% consistency	4.5 +/- 0.5
Ash content	0.8% +/- 0.2%
Moisture holding capacity	1250 (grams water/100 grams oven dry fiber)
Moisture content	12% +/- 3% (Wet weight basis)

- B. Combine mulch with an organic plantago based tackifier, such as M-binder, etc., that has no growth or germination inhibiting factors and is nontoxic. Apply the uniform mixture to the seeded area.

- C. Bagged mulch/tackifier mix that is homogenous within the unit package may also be used. Tackifier shall adhere to the fibers during manufacturing to prevent separation during shipment and to avoid chemical agglomeration during mixing in the hydraulic mulching equipment.

2.5 EROSION CONTROL BLANKET

- A. Provide erosion control blankets of a uniform web of interlocking excelsior wood fibers, weed-free straw, or a combination of straw and coir fibers.

Use an appropriate blanket chosen for the site conditions and functionality for the desired growing seasons.

1. 3:1 slopes or gentler

Single netted blankets	A machine produced erosion control blanket using 100 percent straw or excelsior fibers sewn into a medium weight photo degradable bottom net. Minimum weight of blanket 0.5 lbs/ square yard, such as Greenfix America WS05, etc.
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2. 3:1 – 2:1 slopes

Double netted blankets	A machine produced erosion control blanket using 100 percent straw or excelsior fibers sewn into a medium weight photo degradable top net and a light weight photo degradable bottom net. Minimum weight of blanket 0.7 lbs/ square yard, such as Greenfix America WS072, etc.
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3. 2:1 slopes and steeper and/or 2 growing seasons of protection

Straw/ coir blend blankets	A machine produced straw /coir fiber erosion control blanket using 70 percent straw /30 percent coir fibers sewn into a heavy weight photo degradable top net and a medium weight photo degradable bottom net. Minimum weight of blanket 0.7 lbs/square yard, such as Greenfix America CFS072R, etc.
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- B. Staples: U-shaped, 11 gauge or heavier steel wire, minimum leg length of 8 inches after bending, with a throat approximately 2 inches wide.
- C. Wood Stakes: Use 2 x 2 x 12 inch pine or fir stakes, beveled at one end, in place of wire staples in tuff locations.

2.6 BONDED FIBER MATRIX

- A. Provide Bonded Fiber Matrix (BFM) composed of natural color, long strand wood fiber, produced by therm-mechanical defibration of wood chips and joined together by a high strength non-toxic adhesive, such as Eco-Ageis, etc. The product shall be composed of 90 percent wood fiber, 9 percent blended hydrocolloid-based binder, and 1 percent mineral activators, all by total weight. The BFM shall be 100 percent biodegradable and non-toxic to fish and wildlife, and it shall not contain any synthetic fibers.

2.7 AMENDMENTS / SOIL ADDITIONS

- A. Fertilizer: Apply slow-release organic fertilizers such as Biosol Mix, Biosol, Osmocote, composted manure or approved equal to minimize deficiencies of the topsoil. If composted manure is to be applied, test the nutrient content and interpret before it is used.
- B. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth.
- C. Sand: Clean, washed, and free of toxic materials.
- D. Wood chips: Wood chips shall have a relatively large surface area to volume ratio to be more easily broken down in the soil. Incorporate wood chips at low rates (0.5 ton/ acre) in order to assure the Carbon to Nitrogen ratio in soil is at favorable conditions for plant germination and growth. If higher rates are used, add nitrogen fertilizer to assure nutrient availability to plants.

PART 3 EXECUTION

3.1 PREPARATION

- A. Preparation of the Seedbed:
 - 1. Prepare seedbed to a maximum depth of 4 inches by tilling with a disc harrow or chiseling tool. Uproot all competitive vegetation during seedbed preparation and work soil uniformly, leaving surface rough to reduce surface erosion. Remove large clods and stones, or other foreign material that would interfere with seeding equipment.
 - 2. Do not till on ground that is already loose to a depth of 2 inches or more that has undergone regrading and fill. Till newly cut slopes.
 - 3. Perform tillage across slope when practical and perform in 2 directions whenever one pass is insufficient to adequately break up soil. Do not till up and down slopes, as this will create excessive surface erosion problems.
 - 4. Do not do work when moisture content of soil is unfavorable or ground is otherwise in a non-tillable condition. To minimize dust problems for adjoining areas, do not till when wind speeds are over 10 mph.
 - 5. The extent of seedbed preparation shall not exceed the area on which the entire seeding operation can be accomplished within a 24-hour period.
- B. Soil Amendments/Additions: Uniformly apply slow release organic fertilizer to prepared seedbed in accordance with manufacturer recommended rates.
- C. Prepare seedbed again if prior to seeding LANL Construction Inspector determines that rain or some other factor has affected prepared surfaces and that it may prevent seeding to proper depth.

- D. On excessively steep slopes (steeper than 2:1), hydraulic/broadcast seeding may be appropriate. If seeding in this fashion, multiply application rate of seed by a factor of 2.
- E. If cover crop has been established in area to be seeded, mow cover crop early in growing season before cover crop is ready to drop seeds.

3.2 APPLICATION OF SEED

A. General:

1. Avoid seeding between August 1 and September 30. Do not seed during windy weather, or when topsoil is dry, saturated or frozen.
2. Equip seed boxes used for drill and broadcast seeding with an agitator.
3. To prevent stratification of seed mix, do not run seed box agitators while seeding is not being performed.
4. If seed mix is transported to site in a seed box or other equipment that subjects mix to shaking or similar movement that has the potential to cause stratification, remix seed prior to application.
5. Calibrate seeding equipment in presence of LANL Construction Inspector to determine that equipment setting is appropriate to distribute seed at the specified rates.
6. Unless otherwise shown on Drawings, seed areas disturbed by or denuded by construction operations or erosion.
7. Use markers to ensure that no gaps will exist between passes of seeding equipment.
8. If cover crop has been established, mow the crop and drill seed perennial seed mix into the crop stubble.

B. Drill Seeding:

When drill seeding, plant seed mix at a rate of 20 - 25 PLS lbs/acre. Uniformly apply prescribed mix over area to be seeded as follows:

1. Accomplish seeding operations, where practical, by drilling in a direction across slope.
2. Plant seeds approximately 1/4 inch deep.
3. Do not exceed 4 inches distance between drilled furrows. If furrow openers on drill exceed 4 inches, drill area twice to obtain a 4-inch distance between furrows.
4. Seed with grass wheels, rate control attachments, seed boxes with agitators, and separate boxes for small seed.

C. Broadcast Seeding:

When broadcast seeding, plant seed mix at a rate of 32 - 37 PLS lbs/acre.

1. Where it is not practical to accomplish seeding by drilling, mechanically broadcast seed by use of a hydraulic mulch slurry blower, rotary spreader, or a seeder box with a gear feed mechanism. If seeding is done with a slurry blower, use highest pressure and smallest nozzle opening that will accommodate the seed.
2. Immediately following seeding operation, lightly rake seedbed or loosen with a chain harrow to provide approximately 1/4 inch of soil cover over most of the seed.
3. If hydraulically applying mulch as part of the broadcast seeding process, use a 2 step process. Apply seed with a tracer (200 – 300 lbs/ acre) amount of mulch across entire seeded area. Once seed is applied, apply full complement of mulch (to equal 2000 lbs/ acre). This shall allow seed to be in good contact with soil surface and not suspended in mulch matrix.
4. Prohibit vehicles and other equipment from traveling over the seeded areas.

3.3 STRAW MULCH: Slopes Flatter than 2:1, Non-Irrigated Projects

A. For locations that have not been hydraulically mulched, immediately following raking/chaining operation, add straw mulch to seeded areas.

1. Apply straw mulch at a minimum rate of 1.5 tons per acre of air-dry material. Spread straw mulch uniformly over area either by hand or with a mechanical mulch spreader to achieve 80 percent ground cover. When spread by hand, tear bales of straw apart and fluff before spreading. Depth of applied straw mulch shall not exceed 3 inches. Do not mulch when wind velocity exceeds 10 mph.
2. Wherever use of crimping equipment is practical, place mulch in manner noted above and anchor it into the soil to a minimum depth of 2 inches. Use a crimper or heavy disc such as a mulch tiller, with flat serrated discs at least 1/4 inch in thickness, having dull edges, and spaced no more than 9 inches apart. Provide discs of sufficient diameter to prevent frame of equipment from dragging the mulch. Where practical, perform crimping in 2 (opposite) directions. Do not use Sheep's Foot Rollers, heavy equipment tracks, and standard disc cultivators for crimping.
3. If straw mulched areas cannot be anchored by crimping, use hydraulic mulch wood fibers with tackifier. Mix slurry in a tank with an agitation system and spray under pressure uniformly over the soil surface. Keep all materials in uniform suspension throughout the mixing and suspension cycle when using hydraulic mulching equipment. Mix 100 lb. of wood fiber with 150 lbs. of tackifier to anchor straw mulch. Apply mixture at a rate of 250 lbs/acre.
4. Use both horizontal and vertical movements in the applicator to achieve an even application of the slurry material.

3.4 HYDRAULIC MULCHING/TACKIFIER: Slopes Flatter than 2:1, Irrigated Projects

- A. Immediately following raking/chaining operation, apply hydraulic mulch fibers with tackifier to seeded areas. Mix slurry in a tank with an agitation system and spray, under pressure, uniformly over soil surface. Apply mulch evenly across landscape at a rate of 2000 lbs/ acre.
- B. Use both horizontal and vertical movements in applicator to achieve an even application of slurry material. Keep all materials in uniform suspension throughout mixing and suspension cycle when using hydraulic mulching equipment.
- C. When using plantago based tackifier as mulch, apply tackifier at a rate of 100 lbs/acre. When applied alone for dust control, apply tackifier at a rate of 150 lbs/acre.
- D. Prohibit foot/vehicle traffic from hydraulically mulched areas.

3.5 EROSION CONTROL BLANKET: Slopes 3:1 and Steeper, Irrigated and Non-Irrigated Projects

- A. Place blankets over native grass seeding immediately following the raking/chaining operation.
- B. When using single netted products for 3:1 or flatter slopes, place blanket with netting on top and the wood/ straw fibers in contact with soil over entire seeded area.
- C. For slope installations, the following guidelines shall be used:
 - 1. Begin at top of slope and anchor its blanket in a 6 inch deep by 6-inch wide trench. Backfill trench and tamp earth firmly.
 - 2. Unroll blanket downslope in direction of water flow.
 - 3. Overlap edges of adjacent parallel rolls 2 to 3 inches and staple every 3 feet.
 - 4. When blankets are spliced, place blankets end over end (shingle style) with 6-inch overlap. Staple through overlapped area, approximately 12 inches apart.
 - 5. Lay blankets loosely and maintain direct contact with soil – do not stretch.
 - 6. Staple blankets sufficiently to anchor blanket and maintain contact with soil. Place staples down the center and staggered with the staples placed along the edges. Steep slopes (1:1 – 2:1) require 2 staples per square yard. Moderate slopes (2:1 – 3:1) require 1 to 2 staples per square yard. Gentle slopes require 1 staple per square yard. Use a common row of staples on adjoining blankets.
- D. Use wood stakes on tuff slopes, in place of wire staples. Use same installation rate as for staples. Drive stakes in perpendicular to slope and leave 2 inches exposed above soil grade.

3.6 BONDED FIBER MATRIX (BFM): Slopes 2:1 and Steeper, Irrigated and Non-Irrigated Projects

- A. Hydraulically apply BFM over seeded area (or apply seed with a tracer amount, 200-300 lbs/ acre) immediately following raking/chaining operations and in accordance with manufacturer's specified procedures. Hydraulically apply BFM as a viscous mixture. Upon drying, it shall form a continuous, porous and erosion resistant mat. Upon drying, matrix shall not inhibit germination and growth of plants in and beneath the layer. Matrix shall retain its form despite re-wetting.
- B. Apply matrix uniformly across area and apply in multiple directions to ensure a 100 percent soil surface coverage.
- C. Apply at a rate of approximately 3,500-lbs/ acre in a manner that achieves uniform coverage of all exposed soils.
- D. Prohibit vehicle traffic on hydraulic BFM applications.

3.7 WATERING

- A. Where temporary watering is required for seeded areas, provide temporary water system which may be a sprinkler system, or a water truck with a spray boom or any other method satisfactory to distribute a uniform coverage of clean water (free of oil, acid, salt or other substances harmful to plants) to previously seeded and mulched areas.
- B. If a temporary sprinkler system is used, keep all pipe connections tight to avoid leakage and loss of water, and to prevent washing or erosion of growing areas. Maintain sprinklers in proper working order during watering.
- C. Do not drive trucks with spray systems on seeded areas and ensure water force does not cause movement of mulch or seed on the ground.
- D. Water revegetated areas only if areas were planted between April 15 and July 31.
- E. Apply water at a maximum of 1/2 inch/hour for 2 hours. Additional applications of water may be made as designated by LANL Construction Inspector. Water source will be approved by LANL, prior to use.

3.8 MAINTENANCE

- A. Begin maintenance immediately after planting.
- B. Maintain seeded areas for not less than 60 days after final acceptance of work and longer as required to achieve final stabilization as described in Section 3.10 ACCEPTANCE.
- C. Reseed void areas greater than 6 square feet or repetitive voids greater than 2 square feet amounting to more than 10 percent of any area that appears the growing season following installation.

- D. Keep revegetated areas free of noxious weeds until acceptance by LANL. Contact LANL Construction Inspector prior to application of any control measure.

3.9 CLEANUP AND PROTECTION

- A. After completion of work, clear site of excess soil, waste material, debris and objects that may hinder maintenance and detract from neat appearance of site.
- B. Protect work and materials from damage due to seeding operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged work as directed.

3.10 ACCEPTANCE

- A. Seeded areas will be reviewed for acceptance by LANL when final stabilization has been achieved. Final stabilization is defined as "All soil disturbing activities at the site have been completed and a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 70 percent of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed."
- B. In the event that all other work required by the Contract is completed before final stabilization is achieved or because seasonal limitations prevent seeding, partial acceptance of the work shall be made with final acceptance delayed until satisfactory vegetative growth has been established.

END OF SECTION

Do not delete the following reference information:

FOR LANL USE ONLY

This project specification is based on LANL Master Construction Specification Rev. 3, dated August 30, 2002.